#60-F-272C

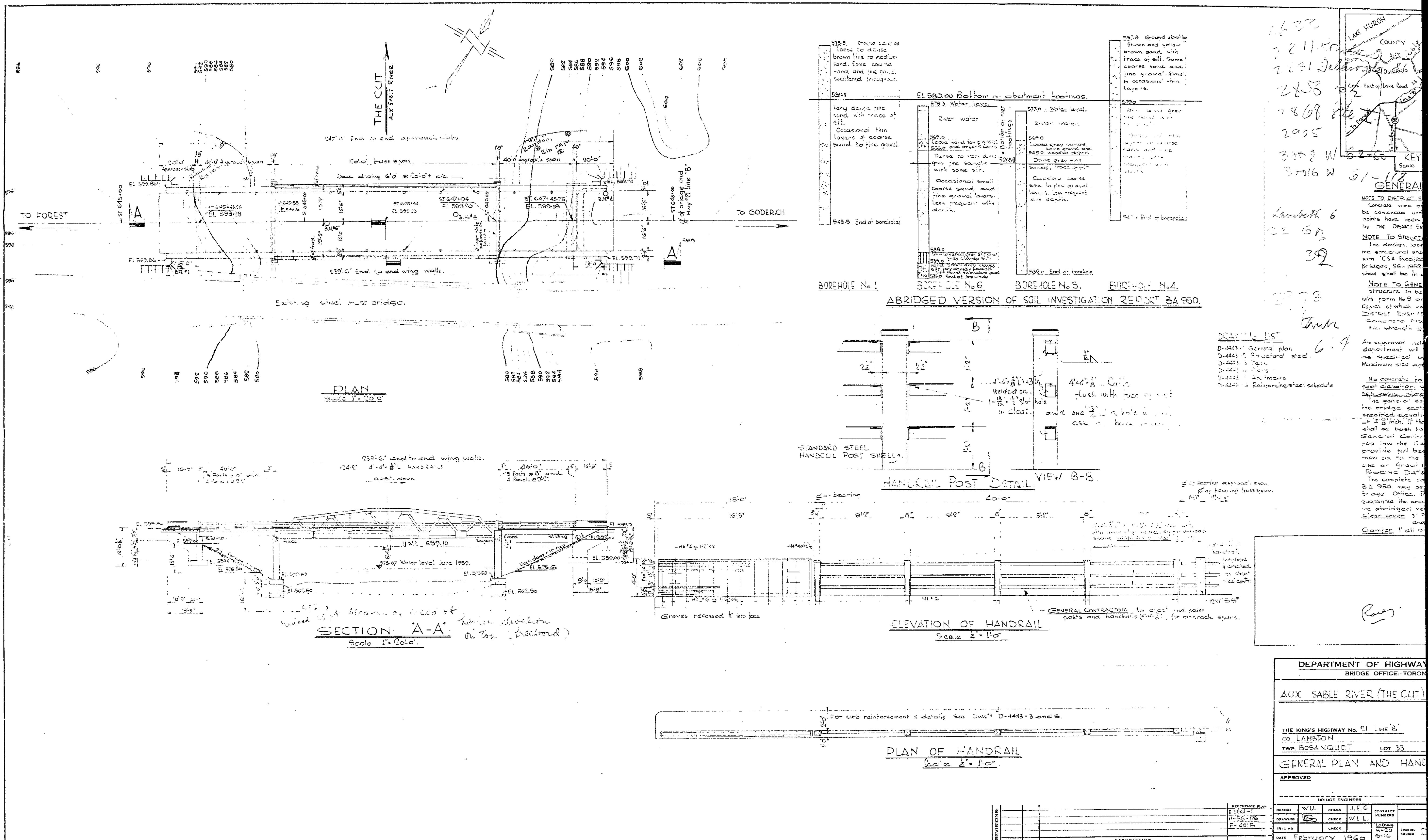
W.P. #143-59

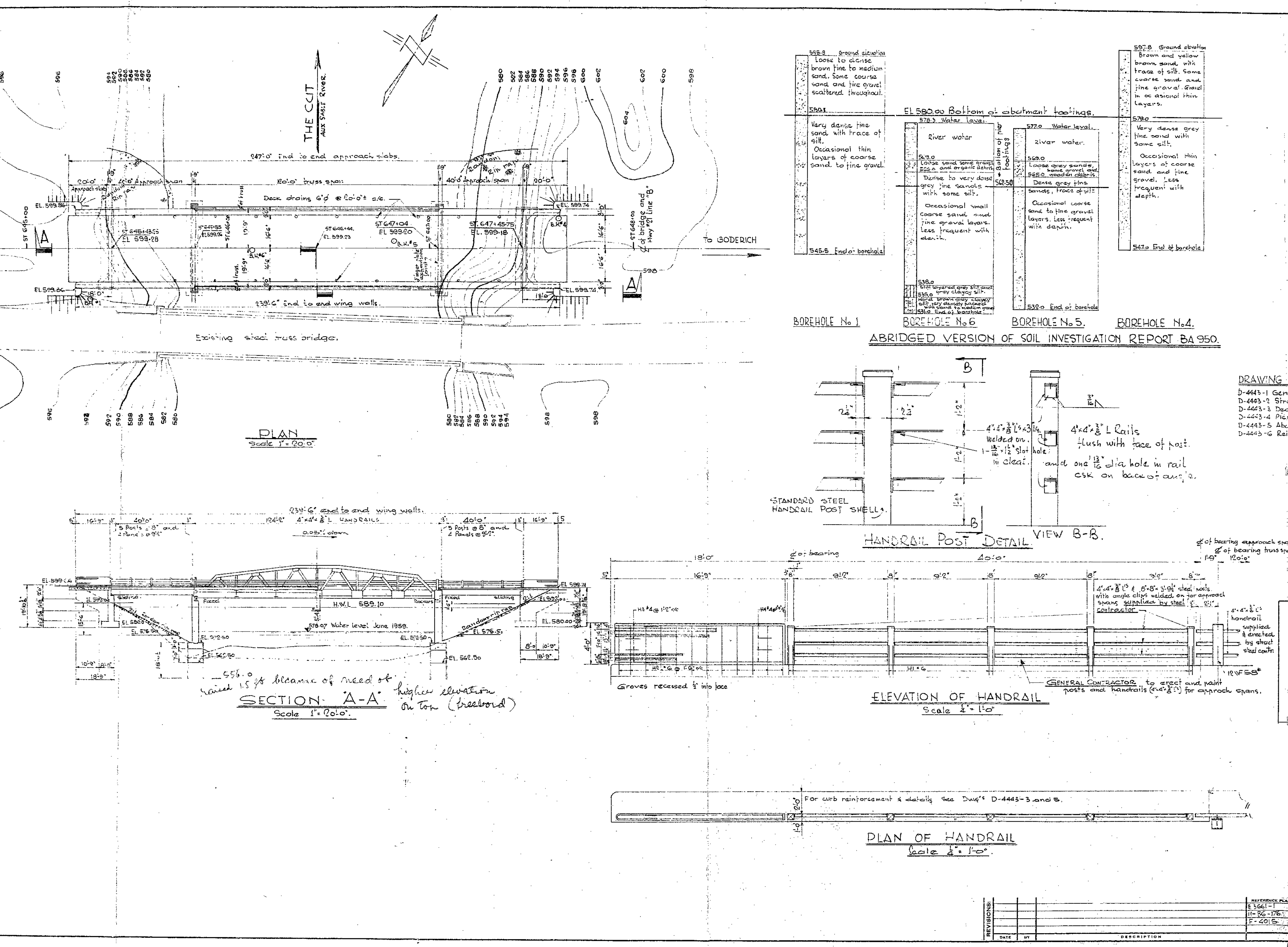
HWY #21 - 0.1 MI.

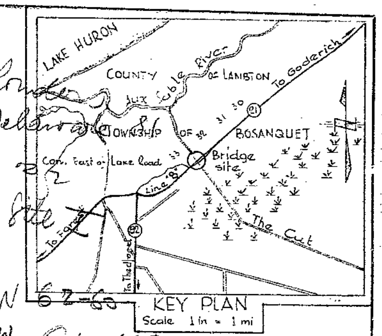
N. OF HWY #82

AUX SAUBLE R.

PROPOSED BRIDGE


THE CUT
AUX SABLE RIVER
TO FOREST
TO GODERICH
Existing steel truss bridge.
PLAN
Scale 1"=20'0"
BOREHOLE No. 1
BOREHOLE No. 6
BOREHOLE No. 5.
BOREHOLE No. 4.
ABRIDGED VERSION OF SOIL INVESTIGATION REPORT BA 950.
STANDARD STEEL HANDRAIL POST SHELL.
HANDRAIL POST DETAIL
VIEW B-B.
SECTION "A-A"
Scale 1"=20'0".
578.07 Water level June 1959.
H.W.L. 589.10
Groves recessed 1/2" into face
ELEVATION OF HANDRAIL
Scale 3/4"=1'0"
For curb reinforcement & details See Dwg's D-4443-3 and 5.
PLAN OF HANDRAIL
Scale 3/4"=1'0".
GENERAL CONTRACTOR to erect and paint posts and handrails for approach spans.
DRAWING LIST
D-4443-1 General plan
D-4443-2 Structural steel
D-4443-3 Deck
D-4443-4 Piers
D-4443-5 Abutments
D-4443-6 Reinforcing steel schedule
KEY
GENERAL
DEPARTMENT OF HIGHWAY
BRIDGE OFFICE: TORON
AUX SABLE RIVER (THE CUT)
THE KING'S HIGHWAY No. 21 LINE "B"
CO. LAMBTON
TWP. BOSANQUET LOT 33
GENERAL PLAN AND HAND
APPROVED
BRIDGE ENGINEER
DESIGN W.L. CHECK J.S.G.
DRAWING CHECK W.L.L.
LOADING H-20 S-16
DATE February 1960
REVISIONS
DATE BY DESCRIPTION





GENERAL NOTES:

NOTE TO DISTRICT ENGINEER
Concrete work on this structure must not be comenced until monuments to fix control points have been erected and checked by the DISRICT ENGINEER.

NOTE TO STRUCTURAL STEEL CONTRACTOR
The design, fabrication and erection of the structural steel shall be in accordance with "CSA Specification for Steel Highway Bridges, S6-1952." The painting of structural steel shall be in accordance with Form No 9.

NOTE TO GENERAL Contractor.
Structure to be built in accordance with form No 9 and Special Provisions, extra copies of which may obtained from the DISTRICT ENGINEER.

Concrete Mix:
Min. strength @ 28 days: 3000 psi structure
2500 psi footings

An approved admixture supplied by the department will be added to all concrete as specified by the Engineer.
Maximum size aggregate 3/4" structure
1 1/2" footings

No concrete to be placed above bridge seat elevation until concrete in deck slab has been placed.

The general contractor for finishing the bridge seats dead level to the specified elevation with a tolerance of ± 1/8 inch. If they are cast too high they shall be bush hammered down by the General Contractor. If they are cast too low the General Contractor shall provide full bearing shims to bring them up to the correct elevations. The use of Grout is prohibited.

BORING DATA:
The complete soil investigation report BA 950. may be examined at the Bridge Office. The department does not guarantee the accuracy of this report or the abridged version shown on these plans.

Clear cover 3" Piers & abutments, 1" deck and 2" elsewhere.

Chamfer 1" all exposed edges.

W.P. 143-59.

DEPARTMENT OF HIGHWAYS:-ONTARIO-
BRIDGE OFFICE:-TORONTO

AUX SABLE RIVER (THE CUT) BRIDGE

THE KING'S HIGHWAY No. 21 LINE 'B' DIST. No. 1
CO. LAMBTON
TWP. BOSANQUET LOT 33 CON. East of Lake Rd

GENERAL PLAN AND HANDRAIL DETAILS.

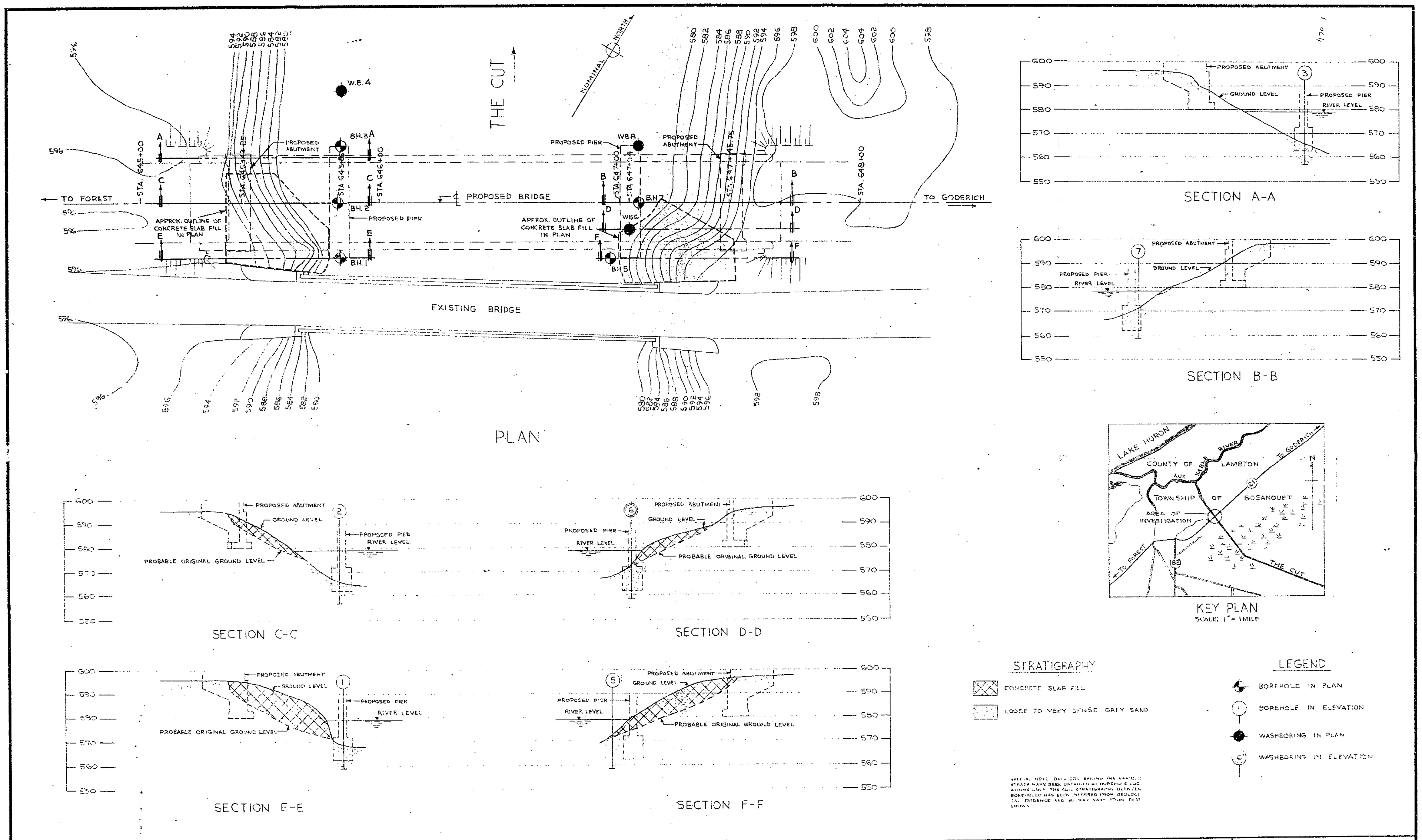
APPROVED

BRIDGE ENGINEER — DESIGN ENGINEER

DESIGN	W.L.L.	CHECK	J.E.G.	CONTRACT NUMBERS	
DRAWING		CHECK	W.L.L.		
TRACING		CHECK		LOADING H-20 S-16	DRAWING NUMBER D-4443-1
DATE	February 1960				

REFERENCE PLANS: E 3661-1, 11-36-176, F-4015

REVISIONS | DATE | BY | DESCRIPTION



REVISIONS		
MARK	DATE	DESCRIPTION

REFERENCE	
DWG. NO.	DESCRIPTION

REFERENCE	
DWG. NO.	DESCRIPTION
D4443-1	DEPARTMENT OF HIGHWAYS, ONTARIO - BRIDGE OFFICE AUX SABLE RIVER (THE CUT) BRIDGE - GENERAL PLAN

DEPARTMENT OF HIGHWAYS, ONTARIO
TORONTO ONTARIO
FILL SURVEY – PIER AND ABUTMENT LOCATIONS
PROPOSED BRIDGE
HIGHWAY 21 NEAR PORT FRANKS ONTARIO
BORING PLAN AND SECTIONS

GEOCON LTD

DATE APRIL 13, 1960 SCALE 1" = 20'-0"

MADE J.A. CHKD. R.S. APPD. JLS No. S7068-1

cc: Foundation Section

93-62-04

Mr. A. M. Toye,

Bridge Engineer.

Materials & Research Section.

October 20, 1959.

Re: FOUNDATION INVESTIGATION -

by Macey, MacCallum & Associate

Attention: Mr. J. McCombie.

Re: Proposed Bridge Across the Aux Sauble River Cut for Hwy. #21 - 0.1 Miles North of Hwy. #52, Ontario. Dist. #1.

Enclosed herewith is the foundation report for the above structure which has recently been submitted to us by Macey, MacCallum & Associates.

Your attention is drawn to the fact that the subsoil at this site consists essentially of fine-grained granular material. At the abutment locations the upper 12 - 15 ft. of this material exists in a loose to medium dense state and is not recommended for the direct support of spread footings. At the abutment locations, spread footings loaded with an intensity of at least 4 tons/sq.ft. can be founded at or below Elevation 580'.

Within the stream channel, spread footings can be founded at or below Elevation 565' using a bearing pressure of at least 4 tons/sq.ft. Steel sheet piling should be used at the pier locations and should be driven to at least Elevation 557'. The sheet piling should be left in place to prevent erosion and undermining of the pier footings.

An alternative to the use of spread footings founded at Elevation 560' at the abutment locations, would be to place the abutments at a higher elevation and have them supported on displacement type piles driven to practical refusal in the dense sandy layer. If this is done, sheet piling protection appears necessary at the abutment locations. The Consultants' recommendation to use wellpoints to dewater excavations in these free-draining materials does not appear to be a sound or necessary recommendation.

If you have any queries with regard to the contents of this report, or our comments, please contact our office.

LGS/MacF

Attach.

L. G. Sederman

L. G. Sederman,
PRINCIPAL SOILS & FOUNDATIONS ENGINEER.

cc: Messrs. A. M. Toye
H. A. Tregaskes
D. G. Manney
A. Watt
A. Gater
C. D. Kowell
J. Key
Pdn. Section - Gen. Files.

ONTARIO

DEPARTMENT OF HIGHWAYS

11 B176
C728-3-1

Box 910,
Chatham, Ontario,
March 10, 1960.

Mr. H. A. Mantle,
Location Engineer,
Planning and Design,
Department of Highways,
Toronto, Ontario.

READING

Re: W. P. 176-59 - Highway #21 - from Junction of Highway #82 and #21 to Grand Bend

Dear Sir:

This is with particular reference to the Diversion which commences at the Junction of Highway #82 and #21 northerly to a point approximately 1,000 feet north of the Aux Sable River Cut Bridge. We note on the projected line B that the centre line is approximately 30 feet from the wing walls of the old structure over the Aux Sable River Cut.

Approximately five years ago in very high water the footings of the old structure were apparently undermined completely and allowed all of the fill in between the wing walls on both sides of the river to go out. This bridge apparently was sitting on piles so it did not collapse, but we immediately proceeded to back fill the wing walls with very heavy rubble and also faced the wing walls and the front of the abutment with random rip rap. The amount used of rip rap outside of the rubble was about 10 car loads and this means that the heavy rip rap stone extends approximately 30 feet out beyond the wing walls and possible more at the toe.

In view of this we feel that the centre line should be shifted away from the old structure to avoid heavy construction costs in removing this rip rap stone, which helps support the face of the wing walls and abutments. I would suggest at least another 20 feet of a move would create much less of a hazard to the old bridge during construction so that the rip rap could be maintained in place during the construction of a new structure.

This shift at the bridge of 20 feet could be very easily taken care of without putting a reverse curve north of the bridge as it would tie into the tangent beyond the bridge approximately 600-700 feet beyond the point of intersection at the present time.

I would agree that some of the work for the design has already been taken care of from the bridge southerly, but I think possible we would have a great deal more safety by moving the centre line to avoid any con-

Mr. H. A. Mantle (Cont'd) March 10, 1960.

plications during construction of this bridge.

If I remember correctly, I was in your office approximately one year ago and you brought this plan out, and apparently design A at that time was the approved route, or that was what I was led to believe. I must admit that the line A as shown on this plan would have overcome a great many difficulties, more particularly the heavy muskeg excavation that is necessary on line B, which is, I believe, up to 10 feet in depth.

If line B is to be maintained, I would suggest this shift at the bridge.

Yours truly,

G. U. Howell,
District Engineer.

GUH/pa

c.c. Mr. C. R. Hopkins,
Regional Office.

Mr. S. McCombie
Bridge Planning Engineer

J. D. Harris

July 31, 1962.

Ausable River, The Cut,
Hwy. 21 District 1
W.P. 143-59 BR 262

In answer to a request from Chatham District office, the site was visited on the 25th of July, in order to assess the adequacy of the proposed scour protection for the new abutments.

From conclusions drawn from the site and office studies, it is definitely agreed that the present design does not provide sufficient protection, and recommendations for remedying this are given later.

History of existing bridge This was constructed around 1924, as a replacement for an older three span bridge of similar length. According to the original drawings the bridge is founded on 13" timber piles driven into the sand subsoil.

At the time of construction, the bottom width of the channel at the bridge was 50', but this has now increased to 150'. The width is even greater away from the bridge. In addition, the river bed during flood is estimated to be 10' deeper now than it was in 1924.

The rapid increase in size of the channel cross-section is due partly to dredging and partly to natural causes. The latter include erosion due to impact of ice floes during the break-up, but the chief factor is the extreme erodibility of the unprotected sand banks of the Cut. This is probably also accentuated by the transition from clay to sand soil a short distance upstream from the highway.

The effect of the erosion on the existing bridge has been to undermine the abutments and wingwalls, causing a collapse and wash-out of the roadway behind the abutments. This is reported to have occurred at least twice in recent years. The structure itself was not destroyed due to the support of the timber piles.

.....2

Remedial work on the bridge included placing rubble behind the abutments and rip-rap in front of the abutments and wingwalls. The channel has also been tapered fairly gradually from its natural width down to the width at the bridge opening, with the aid of rip-rap. Although the latter appears to have been effective so far its performance during a major flood cannot be assessed and it is possible that the sand may tend to wash out from behind the rip-rap.

Proposed bridge Construction of the piers of the new bridge has already started, and the excavation for the north abutment has been completed.

According to the design drawings, the abutment is to be founded on spread footings at elevation 580, or roughly 14' above the lowest point of the river bed. The footing would be on pure sand, and the only scour protection would be a 2' thickness of random rip-rap.

The original soil report #A 950 recommended spread footings for the abutments at or below elevation 580.0, but also that sheet piling be left in as permanent scour protection. However, this was not shown on the drawings. No scour recommendations were made by the Hydrology Section since the drawings and foundation report were not reviewed by that section.

Two separate scour problems have to be dealt with at the new bridge.

The first problem is to ensure the stability of the abutments. In view of the highly erodible nature of the subsoil and the constant widening of the river channel, the only sure protection is the use of steel piles driven to at least 15' below the limits of scour.

The second problem which can occur even if bearing piles are used, is to prevent undermining of the footings and consequent washing out of the roadway behind the abutments. This can be done by driving sheet piling or by the use of carefully graded rip-rap, or by a combination of both. Alternatively, the suggestion made by the bridge Design office that the abutments be designed so that future end spans can be added if necessary appears to be very sound. This would probably be necessary in any case if the old abutments were to collapse.

The existing bridge abutments and rip-rap will be mostly beneficial to the new bridge, although a certain amount of turbulence is created immediately downstream, and for this reason they should be left intact.

Summary of recommendations:

1. The abutment footing should be deepened to elevation 575.0 by placing mass concrete below 580.0.

2. The abutments should be supported on Steel "H" Piles driven to elevation 550.0 or deeper.

3. To prevent loss of the approach fill, either rip-rap or steel sheet piling could be used. However, the most economical solution appears to be that of providing graded rip-rap as recommended below, and constructing additional end spans if found necessary in the future.

4. Rip-rap should consist of a 12" filter of granular "A" material protected by an 18" layer of hand laid 1 man stones. The abutment excavation should be backfilled with gravel, in preference to the natural sand.

5. The existing abutments, wingwalls and rip-rap should be left intact.

6. The fill at and upstream from the existing bridge should be stabilized with suitable vegetation. If practicable, the natural banks should be similarly treated, possibly in co-operation with the Conservation Authority.

JDh/et

J. D. Harris,
for B. Wilkie,
Bridge Hydrology Engineer.

cc. G. Maxell
Attention: F.Peacock
cc. R. Tregaskes
cc. B. Davis
cc. A. Rutka

MEMORANDUM

To: Mr. A. M. Toye,
Bridge Office.

From: District 1, Chatham.

Date: July 23, 1962.

Our File Ref.

In reply to

Subject: Contract 62-04, Highway 21, Bridge Over Ausable River Cut

The original request by the District concerning the location of this bridge was turned down, see my memo of March 10, 1960 to Mr. H. A. Mantel. In its present situation the new bridge can, I think, be constructed without much inconvenience. It is, however, in a protected situation which will cease to be when the old bridge is removed. In confirmation of my teletype to Mr. A. McKim, I wish you to send a competent engineer to examine the site. In my opinion the design of the piers, while I have had considerable misgivings, will now suffice. The Tremie Concrete has been satisfactorily poured in one pier and, although we have had to raise the sheet piling, I believe construction to be satisfactory. This is, however, not the case at the abutments.

The "cut" to Lake Huron is subject to heavy "tidal" movements in accordance with the movements of the lake. This has produced a totally unlooked for amount of scour which endangered the existence of the old bridge. All material in this area is a uniform sand very subject to erosion and it is notable that the banks along the cut are continually sliding in and show no sign of being tied by vegetation. The location of the abutment is well forward of the new general line of the banks. In my opinion the following is required:

(1) Either the abutments are set back further or they are made deeper. The former would introduce delay and waste of steel work if fabricated.
(2) A proper system of anti-erosion protection be designed, this to consist of sheet piling with a concrete protective apron. I place no value on random rip-rap in this instance.

In this connection the sheet piling supplied for the pier does not appear to be of sufficient gauge to cope with the very hard driving.

.....2

DEPARTMENT OF HIGHWAYS ONTARIO

MEMORANDUM

To: Mr. A. M. Toye,
Bridge Office.

From: District 1, Chatham.

Date: July 23, 1962.

Our File Ref.

In reply to

Subject: Contract 62-04, Highway 21, Bridge Over Ausable River Cut

Any major changes will result in setting back the contractor who has been very slow in getting started and has a steel deadline of September 15. Therefore, I would request your urgent consideration.

G. U. Howell,
District Engineer.

PHP:sm

cc Mr. H. A. Tregaskes,
Construction Engineer.

Mr. A. Rutka,
Materials and Research.

Mr. A. Cunliffe,
Site.

RACEY, MacCALLUM AND ASSOCIATES
LIMITED

A COMPANY OWNED, DIRECTED AND OPERATED BY

Consulting Engineers
AND ASSOCIATED STAFF

MONTREAL VANCOUVER

TORONTO

DONALD C. MacCALLUM, B.ENG., M.E.I.C., P.ENG.
H. JOHN RACEY, B.SC., M.E.I.C., P.ENG.
GEORGE L. HOUGHTON, A.M.I.MECH.E., M.E.I.C., P.ENG.

TORONTO DIVISION
27 CARLTON STREET

Reference: S-500/T-1898
- Report -

2nd October, 1959

W.D. 143-59

Ontario Department of Highways,
Materials and Research Division,
C/o Parliament Buildings,
TORONTO - Ontario.

Attention: Mr. L. Soderman.

RE: FOUNDATION INVESTIGATION FOR PROPOSED BRIDGE
ACROSS THE AUX SAUBLE RIVER CUT FOR HWY # 21
0.1 MILES NORTH OF HWY # 82, ONTARIO.

Dear Sir,

The enclosed report presents the results of our foundation investigation at the above location.

We hope the report is satisfactory to you; if you have any questions about it please do not hesitate to get in touch with us.

Thank you for this opportunity of being of service to you.

Yours very truly,
RACEY, MacCALLUM AND ASSOCIATES LIMITED,

J. J. Schoustra, P.Eng.,
Divisional Soil Engineer.

JJS/YDP

Ontario Department of Highways,
Materials and Research Division,
C/o Parliament Buildings,
Toronto.

FOUNDATION INVESTIGATION FOR PROPOSED BRIDGE ACROSS THE AUX SAUBLE RIVER CUT FOR HWY # 21 0.1 MILES NORTH OF HWY # 82, ONTARIO.

Reference: S-500/T-1898
- Report -

Racey, MacCallum and Associates
Limited.

2nd October, 1959.

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TORONTO DIVISION
27 CARLTON STREET

Reference: S-500/T-1898
- Report -

2nd October, 1959

FOUNDATION INVESTIGATION FOR PROPOSED BRIDGE ACROSS THE AUX SAUBLE RIVER CUT FOR HWY # 21 0.1 MILES NORTH OF HWY # 82, ONTARIO.

INTRODUCTION :

It is proposed to replace the present single span steel truss bridge with a longer double span structure located approximately 30 (thirty) feet downstream. The purpose of this investigation was to ascertain and assess the subsoil conditions prevalent at the new bridge location and advise, in as comprehensive manner as possible, on the treatment of the foundation problems etc.,

The results of the investigation together with derived conclusions and recommendations are presented in the following paragraphs.

SITE HISTORY :

The Aux Sauble River Cut is an artifically created watercourse. Its construction aided the drainage of a small lake and extensive marsh land upstream of the bridge. Owing to the pervious nature of the area within its watershed, the Aux Sauble River exhibits very sharp rises in water level after even small or local precipitation. The same properties are true of "The Cut", which is in effect a short route for the river to Lake Huron.

Though at the time of the investigation the river was extremely placid, flowing very slowly indeed, the effect during Spring run-off could easily be visualised. The resulting heavy flow inducing high tractive forces would easily scour the fine sand of the banks and invert. This in time would have the effect of progressively broadening the channel, though the rate at which the broadening takes place would gradually decrease.

The scouring action was so great at one time in recent years that both abutments of the present bridge were washed out. At

this juncture concrete slab waste was dumped around the abutment perimeter as rip rap protection for the future. This seems to have worked quite well to date.

FIELD WORK :

Borings were carried out by means of a standard diamond drill rig specially equipped for soil sampling. Six boreholes were originally planned, four on land and two from a raft in the river. On completion of two diagonally located land holes on opposite banks together with the two holes in the river, it was decided that the sinking of two more land boreholes was unwarranted.

In the dense fine sand encountered, 50 feet was about the maximum depth of hole possible. Running BX casing was not even attempted, as being a waste of time in this type of material. Reliance was made on driving 3 inch pipe ahead and washing clean in the usual fashion. The former process was extremely arduous and very time-consuming, necessitating endless delays whilst the driving rope was cooled down etc., Washing out, generally, was very rapid once the water started to flow back up the casing necessitating great care in order to prevent washing ahead.

In one instance a sample was inexplicably lost. Keeping the casing full of water all the time was found to be sufficient to ensure recovery in the greater percentage of all subsequent sampling.

Operations from the raft were hampered by strong winds and a soft river bottom. These two factors combined tending to drag the anchors and cause the raft to spin about the casing, which delayed operations somewhat.

SUBSOIL CONDITIONS :

A sketch plan of the site area is included as Enclosure No 1, and on it is indicated the location of the four boreholes completed, together with that of the two other boreholes originally planned.

All subsoil data penetration records etc., are plotted for each borehole on Engineering Data Sheets, these being included as Enclosures No 2, 3, 4 and 5.

In the main, the subsoil transected consisted of dense to very dense grey fine sands with some silt and occasional coarse sand and gravel layers. The same material in oxidised form outcrops in the river bank and over the whole surrounding area.

As has been previously stated, 50 feet was about the limit to which boreholes could be advanced before the sands locked the

casing. Thus it was only in one borehole (No 6) that contact was made with a lacustrine deposit of varved silt overlying very dense clayey silt till material.

The penetration records for the two boreholes (No 5 and 6) carried out from a raft are seen to be erratic and in general indicate the subsoil to be in a somewhat less dense state than that revealed in Boreholes No 1 and 4. It is felt that this state of affairs is due primarily to a combination of events occurring during the drilling and sampling operations. In such fine grained soil the process of washing out the casing needed extreme care and precise judgement to be used, in order to prevent over-washing. Added to this was the fact that as rods are removed the soil at the open end of the casing is acted on by excess water pressure. Both these effects caused the soil about to be sampled to become disturbed, flow and decrease in density. Remedial measures did reduce this effect, but did not ensure 100% success.

Assessment of the relative density throughout must be made taking due consideration of these practical effects.

FOUNDATIONS AND CONSTRUCTION :

The structure could be founded on either spread footings or some form of friction displacement pile, though use of the former is thought more logical. As the subsoil is so dense, driving of piles would be extremely hard so much so that in such a foundation the use of timber piles is not recommended.

END ABUTMENTS :

These abutment piers should be founded on spread footings installed at approximately Elevation 580 feet. Installation should proceed within a sheet pile cofferdam, which would remain as a permanent feature for scour protection purposes. Construction and excavation within the cofferdam during summer months would largely be completed in the dry. In order to pour the footings in the dry and avoid disturbing the soil, it is recommended that a well point system be employed.

An allowable bearing pressure of 5 tsf is recommended for use in the structural design of the footings. Such a design pressure would ensure a maximum total and differential settlement of one inch and three-quarters of an inch respectively.

CENTRAL PIER :

In this case also it is recommended that the pier be formed within a sheet pile cofferdam, which would be retained as a permanent feature for necessary scour protection purposes.

Taking into account the practical effects already dealt with, the subsoil in the region of this pier would appear to be slightly less dense. In this case the driving of displacement piles would be easier but, even so, quite difficult, rendering the use of timber piles out of the question. Open ended pipe piles would probably be the only type which could be driven with any real assurance of success.

Though the use of a pile foundation remains a possibility, it is felt that spread footings would be more suitable. Such footings could be placed at or below Elevation 560 feet and an allowable bearing pressure of 8,000 psf used for design purposes.

In order that installation of footings could proceed in the dry, a full well-point system installed in a sand island around the cofferdam would have to be installed to lower the ground water.

In view of the relative complexity of such an arrangement, it would seem preferable to excavate and pour in the wet up to the top of the sheet piling. Once again this would be most suitably done during summer months when the river level is low.

Though the sheet piling will give adequate protection against undermining of the piers, some protection should be afforded the training banks so as to combat the possibility of washing out the approach embankments. Rip rap should be placed along the upstream and downstream channel banks, and in such a manner as not to constrict the river flow at the bridge. For rip rap and possible granular backing design purposes, a mechanical analysis was performed on a sample of the bank material to be protected. The grain size distribution chart is included as Enclosure No 6.

CONCLUSIONS :

From the results of the investigation certain facts, conclusions and recommendations have been derived. These are presented below :

1. The subsoil consists primarily of very dense grey fine sand, although layered lacustrine silt and hard glacial till were contacted in one location below Elevation 538 feet.

2. The proposed structure should be founded on spread footings protected within a permanent sheet pile cofferdam.

Reference: S-500/T-1898
- Report - Continued.

2nd October, 1959

CONCLUSIONS : Continued -

3. Footings for the central pier should be designed on the basis of an 8,000 psf allowable bearing pressure, whilst footings for the side abutments should be designed on the basis of a 10,000 psf pressure.

4. Side abutment pier footings should be placed at or below Elevation 580 feet. The central pier abutment footings should be placed at or below Elevation 560 feet.

5. Each pier should be enclosed within a sheet pile cofferdam driven to such a depth as to guard against undermining scour.

6. The river bank upstream and downstream of the structure should be protected with selected protective rip rap. Use of a gravel backing is dependent on the grading of the selected rip rap.

7. Excavation within the sheet pile cofferdam must proceed in the dry for the side abutments.

8. Dewatering the above excavation area by means of well points is recommended.

9. For the central pier, excavation and concrete placement in the wet is recommended.

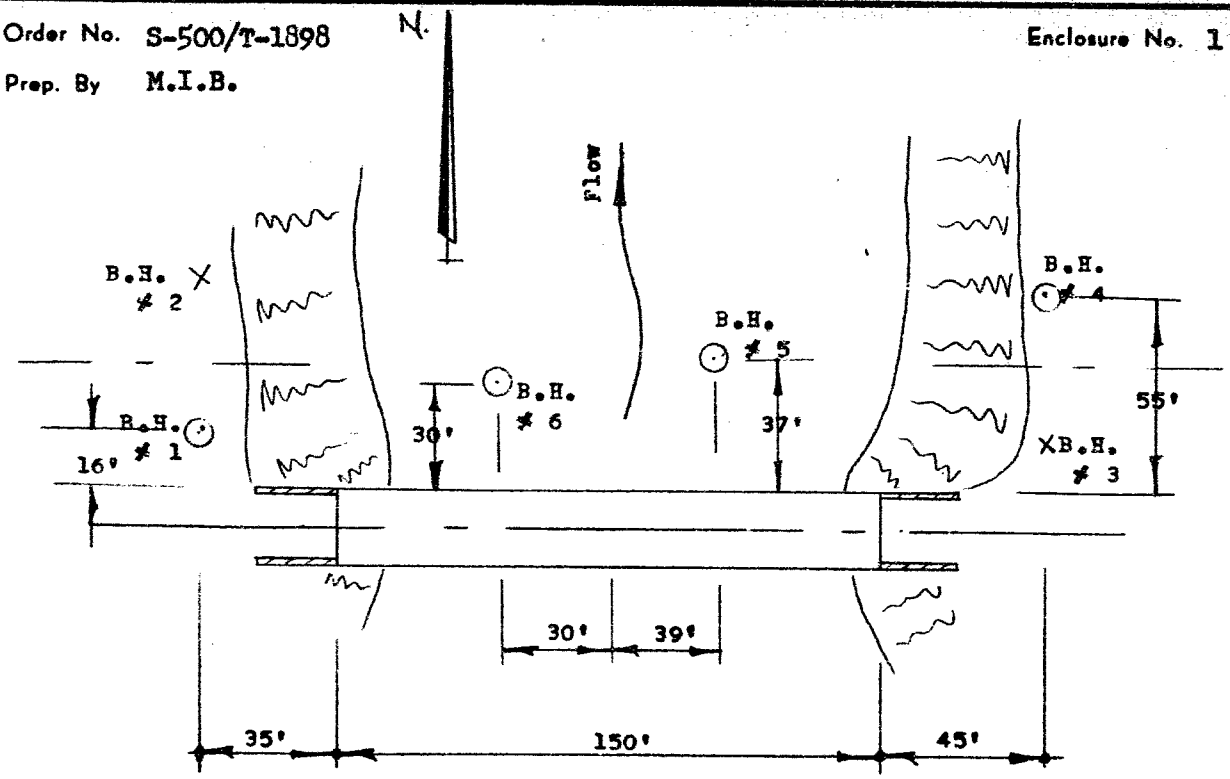
M. I. Beeby, P.Eng.,
Project Engineer.

MIB/YDP

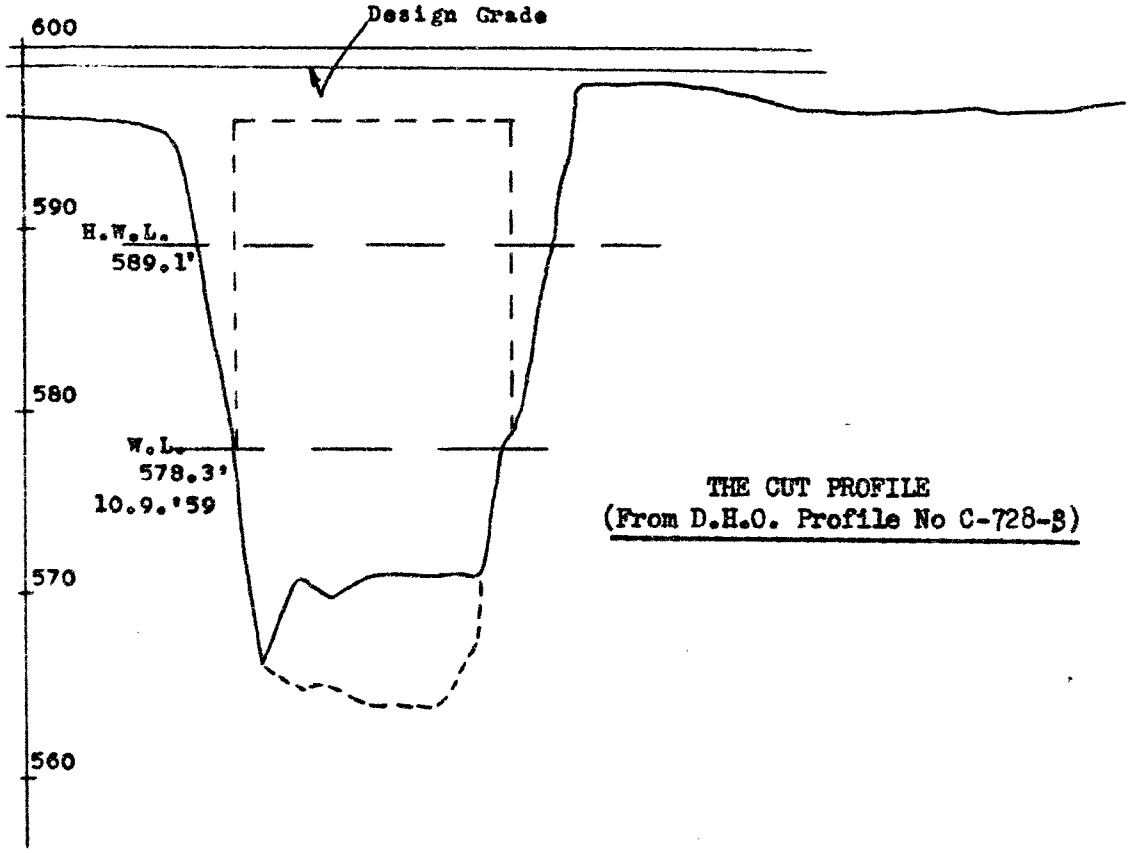
Order No. S-500/T-1898

Prep. By M.I.B.

Enclosure No. 1



SKETCH PLAN
LOCATION OF BORINGS.



THE CUT PROFILE
(From D.H.O. Profile No C-728-8)

Racey, MacCallum & Associates Ltd.

Order No. S-500/T-1898 Enclosure No. 2

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: **No 1**

Project: AUX SAUBLE RIVER CUT - BRIDGE.
Location: IPPERWASH - LAKE HURON.
Hole Location: See Enclosure No 1.
Hole Elevation and Datum: 595.8 Feet.
Field Supervisor: M.I.B. Prep.: M.I.B.
Driller: F.B. Checked: Date:

LEGEND
Shear Strength (C)
Unconfined compression ⊕
Vane test and sensitivity (S) +S
Penetration Resistance (P)
2" Split tube ⊖⊖
2" Dia. Cone ——
Casing - - - - - -

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Ground Elevation.	595.8	0
	Loose to dense brown fine to medium sand. Some coarse sand and fine gravel scattered throughout.		10
	Very dense grey fine sand with trace of silt. Occasional thin layers of coarse sand to fine gravel.	580.8	20
			30
			40
	End of borehole.	545.5	50

STRENGTH AND PENETRATION RESISTANCE
C P.S.F.
P BLOWS/FT
0 20 40 60 80 100

SS-1 SS-2 SS-3 SS-4 SS-5 SS-6 SS-7

LEGEND :
Split spoon sample.

Order No. S-500/T-1898 Enclosure No. 3

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: No 4.

Project: AUX SAUBLE RIVER, CUT - BRIDGE
Location: IPPERWASH - LAKE HURON.
Hole Location: See Enclosure No 1.
Hole Elevation and Datum: 597.8 Feet.
Field Supervisor: M.I.B. Prep.: M.I.B.
Driller: F.B. Checked: Date:

LEGEND
Shear Strength (C)
Unconfined compression ⊕
Vane test and sensitivity (S) +S
Penetration Resistance P.
2" Split tube ⊖⊖
2" Dia. Cone ——
Casing - - - - - -

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Ground Elevation.	597.8	0
	Brown and yellow brown sand with trace of silt. Some coarse sand and fine gravel. Gravel in occasional thin layers.		10
		579.0	20
	Very dense grey fine sand with some silt. Occasional thin layers of coarse sand and fine gravel. Less frequent with depth.		30
			40
		547.0	50
	End of Borehole.		60

STRENGTH AND PENETRATION RESISTANCE
C P.S.F.
P BLOWS/FT. 20 40 60 80 100

SS-1 SS-2 SS-3 SS-4 SS-5 SS-6 SS-7 SS-8

Order No. S-500/T-1898 Enclosure No. 4

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

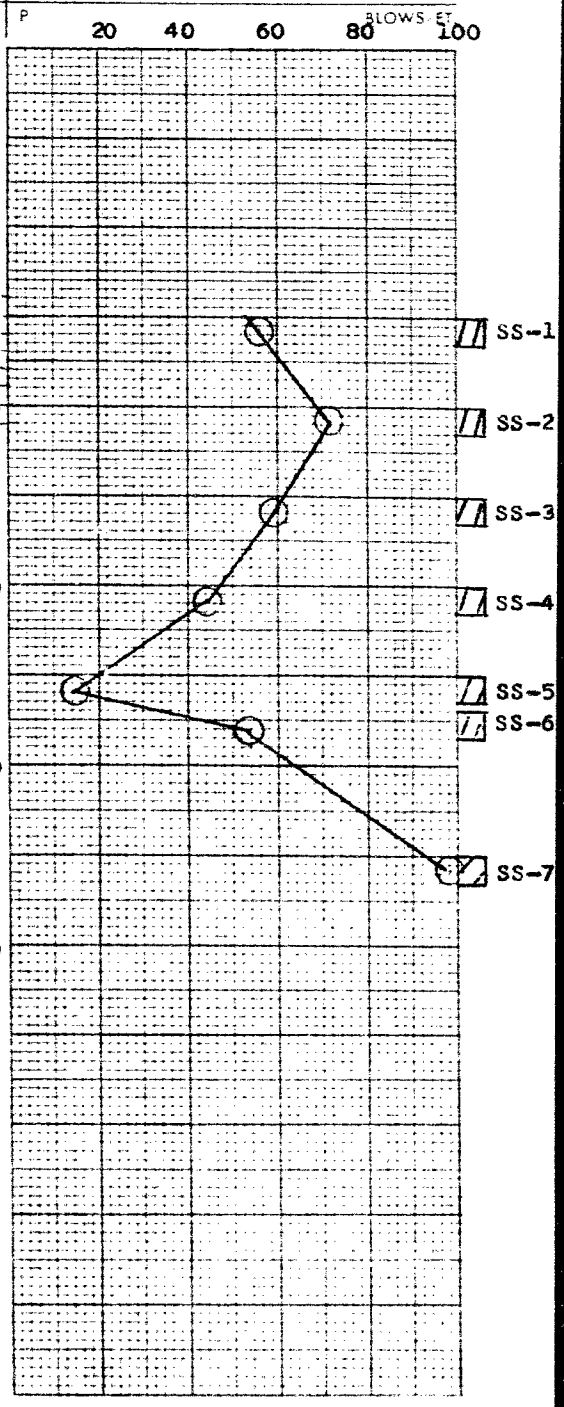
Engineering Data Sheet for Borehole: No 5

Project: AUX SAUBLE RIVER CUT - BRIDGE
Location: IPPERWASH - LAKE HURON.
Hole Location: See Enclosure No 1.
Hole Elevation and Datum: 577.8 Feet.
Field Supervisor: M.I.B. Prep.: M.I.B.
Driller: F.B. Checked: Date:

LEGEND
Shear Strength (C)
Unconfined compression ⊕
Vane test and sensitivity (S) +S
Penetration Resistance P
2" Split tube ⊙—⊙
2" Dia. Cone
Casing

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Raft Deck.	577.8	0
	River water.	577.0	
	Loose grey sands, some gravel and wooden debris.	569.0	10
	Dense grey fine sands, trace of silt. Occasional coarse sand to fine gravel layers. Less frequent with depth.	565.0	20
	End of Borehole.	532.0	30
			40
			50

STRENGTH AND PENETRATION RESISTANCE
C P.S.F.
P BLOWS/FT
20 40 60 80 100



LEGEND :
Split spoon sample.

Order No. S-500/T-1898 Enclosure No. 5

RACEY MacCALLUM AND ASSOCIATES LTD.

Foundation Engineering Division

Engineering Data Sheet for Borehole: No 6

Project: AUX SAUBLE RIVER, CUT - BRIDGE
Location: IPPERWASH - LAKE HURON.
Hole Location: See Enclosure No 1.
Hole Elevation and Datum: 579.0 Feet.
Field Supervisor: M.I.B. Prep.: M.I.B.
Driller: F.B. Checked: Date:

LEGEND
Shear Strength (C)
Unconfined compression ⊕
Vane test and sensitivity (S) +S
Penetration Resistance (P)
2" Split tube ⊖⊖
2" Dia. Cone
Casing

SYMBOL	DESCRIPTION	ELEV. FEET	DEPTH FEET
	Raft Deck.	579.0	0
	River water.	578.3	
	Loose sand some gravel and organic debris.	569.0	10
	Dense to very dense grey fine sands with some silt. Occasional small coarse sand and fine gravel layers. Less frequent with depth.	566.0	
	Stiff layered grey silt and brown grey clayey silt.	538.0	40
	Hard brown grey clayey silt very densely packed with sand to medium gravel.	535.0	
	End of Borehole.	531.0	50

STRENGTH AND PENETRATION RESISTANCE
C P.S.F.
P BLOWS/FT.
20 40 60 80 100
0 10 20 30 40 50 60

SS-1 SS-2 SS-3 SS-4 SS-5 SS-6 SS-7 SS-8 TW-9 SS-10

LEGEND :

Split spoon sample.

Shelby tube sample.

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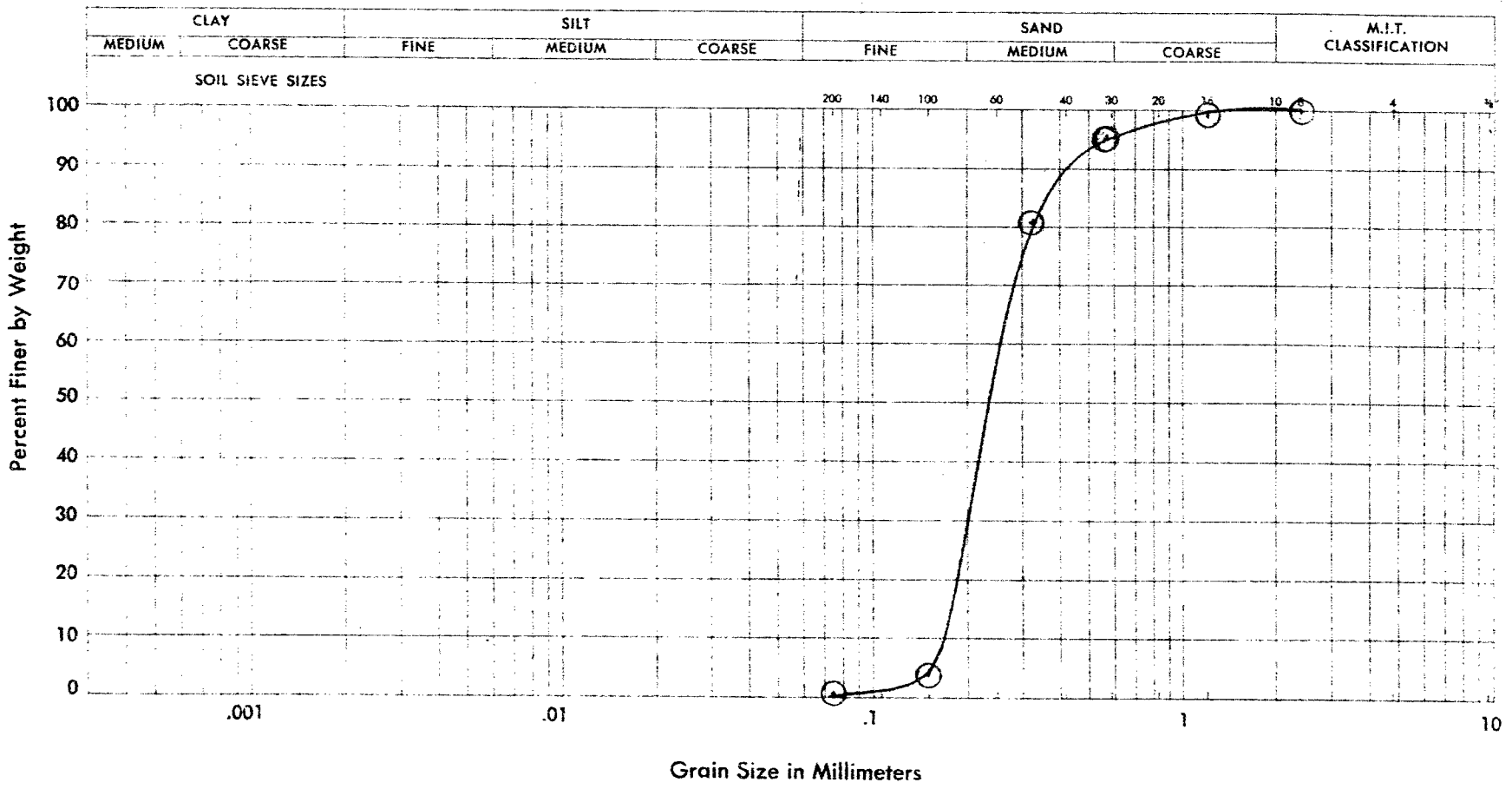
GRAIN SIZE DISTRIBUTION



Project AUX SAUBLE RIVER CUT BRIDGE

Order No. S-500/T-1898

Legend —○———○— Representative sample of material constituting the river banks.

OVER

OVER

Enclosure No. 6

BRUCE McCALLUM

Project Supervisor